

ATTORNEY'S DOCKET NO: 82341

BOX PCT

U.S. DEPARTMENT OF COMMERCE, PATENT AND TRADEMARK OFFICE		DATE: 11 December 2001 (11.12.2001)
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLN. NO. (if known): Not Yet Assigned 10/009516
INTERNATIONAL APPLICATION NO.: PCT/GB00/02348	INTERNATIONAL FILING DATE: 15 June 2000 (15.06.2000)	PRIORITY DATE CLAIMED: 15 June 1999 (15.06.1999)
TITLE OF INVENTION: CARBON MONOXIDE SENSOR		
APPLICANT(S) FOR DO/EO/US: KING, Walter John		

Applicant hereby submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

- ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371
- ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
- ☒ This express request to begin national examination procedures (35 USC 371(f)) The submission must include items(5), (6), (9) and (21) indicated below.
- ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
- ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2)):
 - ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - ☒ has been communicated by the International Bureau.
 - ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
- ☐ A English translation of the International Application as filed (35 U.S.C. 371(c)(2)).
- ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - ☐ are attached hereto (required only if not transmitted by the International Bureau).
 - ☒ have been communicated by the International Bureau
 - ☐ have not been made; however, the time limit for making such amendments has NOT expired
 - ☐ have not been made and will not be made.
- ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
- ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
- ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

ITEMS 11 to 20 BELOW CONCERN OTHER DOCUMENT(S) OR INFORMATION INCLUDED:

- ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
- ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included
- ☒ A **FIRST** preliminary amendment.
- ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment
- ☐ A substitute specification.
- ☐ A change of power of attorney and/or address letter.
- ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter2 and 35 USC 1821 - 1825
- ☐ A second copy of the published international application under 35 USC 154(d)(4)
- ☐ A second copy of the English language translation of the international application under 35 USC 154(d)(4)
- ☒ Other items or information:

TRANSMITTAL FORM; FEE CALCULATION; INTERNATIONAL PUBLICATION WO 00/77505 A2; INTERNATIONAL PUBLICATION DATE 21 DECEMBER 2000 CONSISTING OF 8 PAGES INCLUDING; 1 COVER SHEET CONTAINING THE ABSTRACT; 4 PAGES TEXTUAL SPECIFICATION, 2 PAGES OF 13 CLAIMS; 1 SHEET DRAWINGS; PCT/IPEA/416 AND PCT/IPEA/409 INTERNATIONAL PRELIMINARY EXAMINATION REPORT WITH 2 SHEETS OF ANNEXES OF THE ARTICLE 34 AMENDMENTS; PRELIMINARY AMENDMENT TO ANNEXES WITH ATTACHMENTS A AND B TO BE EXAMINED; UNEXECUTED INVENTORS DECLARATION; PCT/ISA/210 INTERNATIONAL SEARCH REPORT; PCT/RO/101 REQUEST; PCT/IPEA/401 DEMAND; PCT/IPEA/402 NOTIFICATION OF RECEIPT OF DEMAND BY COMPETENT INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

ATTORNEY'S DOCKET NO. 82341

U.S. APPLICATION NO. (if known) not yet assigned 10/009516		INTERNATIONAL APPLICATION NO. PCT/GB00/02348		DATE: 11 December 2001 (11.12.2001)	
17. <u>x</u> The following fees are submitted:				<u>CALCULATIONS</u>	<u>PTO USE ONLY</u>
Basic National Fee (37 CFR 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO:.....\$890.00				\$890.00	
International preliminary examination fee paid to USPTO (37 CFR 1.482)\$710.00					
No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....\$740.00					
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO..... \$1040.00					
International preliminary examination fee (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....\$ 100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$ 890.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <u> 20 </u> <u> 30 </u> months from the earliest claimed priority date (37 CFR 1.492(e)).				\$	
CLAIMS	NO. FILED	NO. EXTRA	RATE		
TOTAL	12 -20=	0	X \$ 18 00	\$	0.00
INDEPENDENT	2 - 3=	0	X \$ 84.00	\$	0.00
Multiple dependent claims(s) (if applicable)			+ \$270.00	\$	0.00
TOTAL OF ABOVE CALCULATIONS =				\$	890.00
Reduction by ½ for asserting small entity, if applicable. (Note 37 CFR 1.9, 1.27, 1.28).				\$	445.00
SUBTOTAL =				\$	445.00
Processing fee of \$130.00 for furnishing the English translation later than <u> 20 </u> <u> 30 </u> months from the earliest claimed priority date (37 CFR 1.492(f)).				\$	0.00
TOTAL NATIONAL FEE =				\$	00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +				\$	0.00
TOTAL FEES ENCLOSED =				\$	445.00
				Amount to be refunded	\$
				charged	\$

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a. ☒ One check in the amount of \$445.00 to cover the above fees is enclosed

b. ☐ Please charge my Deposit Account No. 14-0112 in the amount of \$_____ to cover the above fees. (A duplicate copy of this sheet is enclosed)

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-0112.

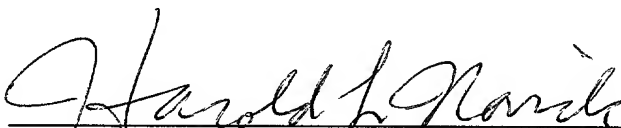
d. Fees are to be charged to a credit card ____ WARNING: Information on this form may become public ____ Credit Card Information should not be included on this form. ____ Provide credit card information and authorization on PTO-2038 ____

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed to request that the application be restored to pending status.

Send All Correspondence To:

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 Harold L. Novick
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 Registration Number 47,421
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Rev. 02/98

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

KING, Walter John

International Application No. PCT/GB00/02348

Serial No. NOT YET ASSIGNED

International Filing Date: 15 June 2000 (15.06.2000)

Filed: December 11, 2001

For: CARBON MONOXIDE SENSOR

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to examining on the merits and calculating the filing fee for the national phase application filed herewith, please enter the following amendments:

IN THE CLAIMS:

It is assumed that the claims in this case are claims 1-12 sent to the International Preliminary Examining Authority by telefax of 13 July 2001 and attached to the International Preliminary Examination Report (IPER). Accordingly please amend claims 3, 7, 8, 9, 10, 11 and 12 to read as per attached "Attachment A" with this preliminary amendment. A version showing the changes made is attached as "Attachment B". A copy of the claims attached to the IPER are attached hereto.

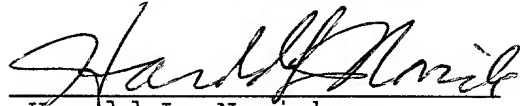
REMARKS

The above amendments have been made to remove multiple dependencies from the claims and to conform them to U.S. practice. No new matter has been added. Pursuant to the new

rules implementing the AIPA, a clean copy of the amended claims is attached, Attachment A, along with a marked-up version of the claims, Attachment B, showing the changes made.

Respectfully submitted,

NATH & ASSOCIATES PLLC

By: 
Harold L. Novick
Registration No. 26,011
Marvin C. Berkowitz
Registration No. 47,421
Customer No. 20529

Date: November 11, 2001
NATH & ASSOCIATES
1030th Street, NW - 6th Floor
Washington, D.C. 20005
HLN/MCB/dd:AMENDpreml.AIPA

ATTACHMENT A - CLEAN COPY

3. (Amended) Apparatus according to claim 1, in which the sensor means comprise an electrochemical sensor comprising two electrochemically-active electrodes separated by an electrolyte absorbed on a porous substrate.
7. (Amended) Apparatus according to claim 3, in which the porous substrate comprises a plastics polymeric material.
8. (Amended) Apparatus according to claim 3, in which the electrolyte is acidic.
9. (Amended) Apparatus according to claim 1, in which the aqueous medium contains sulphuric acid or other water-retention substance.
10. (Amended) Apparatus according to claim 1, in which the aqueous medium is absorbed on a solid absorbent matrix.
11. (Amended) Apparatus according to claim 1 and including a porous barrier to exclude airborne particulates from the pre-treatment means.

12. (Amended) A method for sensing the presence of carbon monoxide in a gaseous test substrate which may also contain contaminating substances, the method comprising pre-treating the substrate by passage thereof through an aqueous medium to absorb any contaminating substances and over a catalyst at ambient temperatures to convert said contaminating substances to non-contaminating substances and testing the residue of the test substrate for the presence of carbon monoxide.

ATTACHMENT B - MARKED-UP COPY

3. (Amended) Apparatus according to claim 1 [or claim 2], in which the sensor means comprise an electrochemical sensor comprising two electrochemically-active electrodes separated by an electrolyte absorbed on a porous substrate.
7. (Amended) Apparatus according to [any of claims 3 to 6] claim 3, in which the porous substrate comprises a plastics polymeric material.
8. (Amended) Apparatus according to [any of claims 3 to 7] claim 3, in which the electrolyte is acidic.
9. (Amended) Apparatus according to [any preceding claim] claim 1, in which the aqueous medium contains sulphuric acid or other water-retention substance.
10. (Amended) Apparatus according to [any preceding claim] claim 1, in which the aqueous medium is absorbed on a solid absorbent matrix.
11. (Amended) Apparatus according to [any preceding claim] claim 1 and including a porous barrier to exclude airborne particulates from the pre-treatment means.

12. (Amended) A method for sensing the presence of carbon monoxide in a gaseous test substrate which may also contain contaminating substances, the method comprising pre-treating the substrate by passage thereof through an aqueous medium to absorb any contaminating substances and over a catalyst at ambient temperatures [and] to convert said contaminating substances to non-contaminating substances and testing the residue of the test substrate for the presence of carbon monoxide.

Carbon Monoxide Sensor

This invention relates to apparatus for detection of carbon monoxide.

Among the available methods of detecting carbon monoxide, electrochemical sensors have shown great promise as they are relatively cheap, sensitive and reliable. However, they suffer the disadvantage that they are inherently sensitive to a wide range of substances and as a result are liable to give erroneous responses in service.

It is an object of the present invention to provide a carbon monoxide sensor which is of enhanced specificity compared with electrochemical sensors and which preferably does not require a source of power.

According to one aspect of the present invention, a carbon monoxide sensor comprises pre-treatment means and sensor means, the pre-treatment means comprising means to absorb contaminating substances and means to convert contaminating substances to non-contaminating substances.

By "contaminating substances" is meant elements or compounds in gaseous or vapour form which if incident on the sensor means would themselves be detected and which could thus give rise to an erroneous or misleading result of carbon monoxide presence or concentration.

Preferably, the pre-treatment and sensor means are contained in separate chambers which are in mutual communication, the pretreatment chamber including access means for the gaseous test substrate.

The sensor means may comprise an electrochemical sensor preferably of the fuel cell type and comprising two electrochemically-active electrodes separated by an electrolyte absorbed on a porous substrate. The electrodes are electrically connected to a display device by current-carrying leads which preferably comprise platinum wire. The sensor electrodes may comprise a precious metal as catalyst, optionally disposed on a suitable

support or, alternatively, applied direct to the electrode surface in finely-divided form such as platinum black. The porous substrate may comprise a plastics polymeric material such as polyvinyl chloride or polyethylene and the electrolyte is preferably acidic, such as sulphuric acid at a concentration between 0.1 and 10M.

The absorption pre-treatment means is preferably an aqueous medium, since most of the common contaminating substances including ammonia, sulphur dioxide, hydrogen sulphide, ethanol and other organic contaminants such as other alcohols and aldehydes, as well as acidic and alkaline gaseous substances, are soluble or highly soluble in water.

The partition coefficients between air and water for the above compounds are as follows: ammonia 0.0014 (20°C); sulphur dioxide 0.0125 (20°C); hydrogen sulphide 0.37 (20°) and ethanol 0.0004 (34°C). By contrast, carbon monoxide has a partition coefficient of 45 (20°C) and thus is predominantly non-absorbed by an aqueous pre-treatment means.

To inhibit evaporation and to prevent eventual drying, the aqueous medium preferably contains sulphuric acid or other water-retention substance.

The aqueous medium is preferably itself absorbed on a solid absorbent matrix such as porous polyethylene, polyvinyl chloride or other inert plastics material.

The function of the conversion pre-treatment means is to oxidise the absorbed contaminating substances which would otherwise accumulate in and eventually saturate the absorption medium. The conversion means is preferably chemically catalytically active to avoid the need for a source of power; the catalyst is preferably a heterogeneous catalyst comprising platinum or other precious metal which may be dispersed on a support material such as activated carbon or a zeolite provided that the catalyst is not thereby made active for carbon monoxide oxidation. However, the preferred catalyst is finely divided platinum metal such as platinum black.

Preferably, the sensor includes a porous barrier to exclude airborne particulates from the pre-treatment means.

In another embodiment, the invention provides a method for sensing the presence of carbon monoxide in a gaseous test substrate which may also contain contaminating substances, the method comprising pre-treating the substrate to absorb any contaminating substances and to convert said contaminating substances to non-contaminating substances and testing the residue of the test substrate for the presence of carbon monoxide.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, of which

Figure 1 is an exploded view of the component parts of a carbon monoxide sensor and

Figure 2 is a cross sectional view of the sensor made from the parts shown in Figure 1.

Referring firstly to Figure 1, the sensor device has a base housing 11 in the form of a circular plate 12 having an upstanding annular wall 13 defining an outer annular flange 14 and a central circular cavity 15. At the bottom of the cavity is placed a circular disc 16 of porous polyvinyl chloride containing 5M sulphuric acid solution absorbed therein and the electrodes are placed thereon. The electrodes are constituted by a porous polyvinyl chloride disc 17 with 5M sulphuric acid absorbed therein and coated on its surfaces with respective catalytic layers of platinum black, the upper surface being the working electrode for electrochemical oxidation of carbon monoxide and the lower surface being the counter-electrode to complete the electrochemical circuit by reduction of oxygen. Connecting wires 18 pass the electricity generated to a warning or display device (not shown).

Over the working electrode is placed an impervious annular disc 19 having a depending outer flange 19A which spaces the disc 19 from the working electrode to form a sensor chamber B (Figure 2). The disc carries an annular sheet of porous polyvinyl chloride 20 having dilute sulphuric acid absorbed therein and carrying a catalytic surface coating of platinum black. A circular disc or membrane 21 of porous PTFE overlies the sheet 20 and acts as a barrier layer to exclude particulates, and a top plate 22 having holes formed therein is inserted at the top of the cavity 15. The plate 22 has a depending outer flange

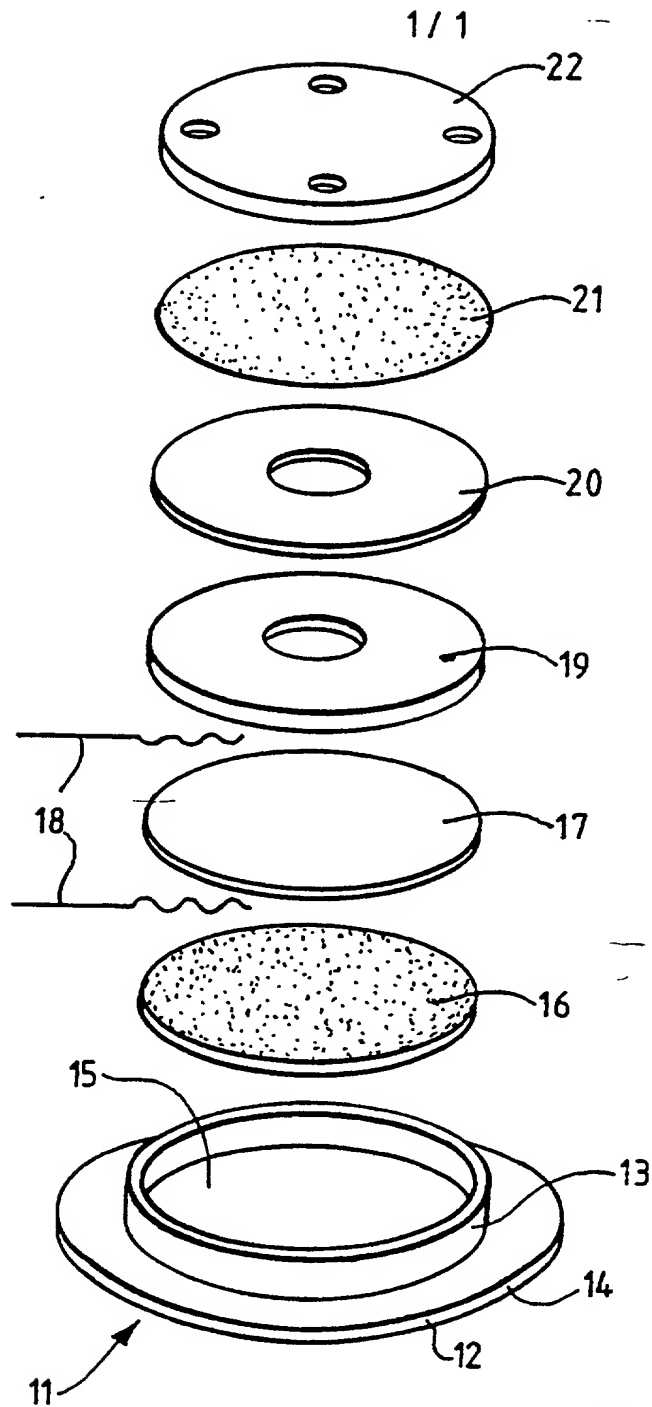
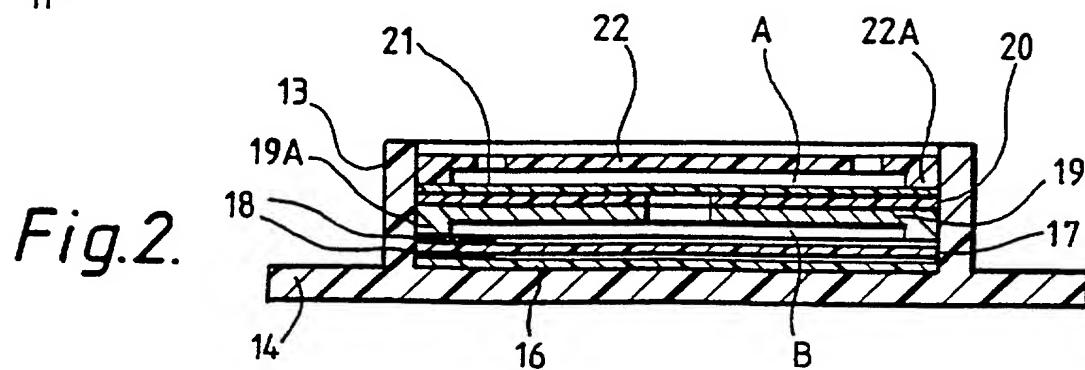
22A which spaces the plate from the barrier layer to form in conjunction with the barrier layer and annular sheet 20 a pretreatment chamber A .

In use, ambient air passes by diffusion through the holes in plate 22 into pretreatment chamber A where it initially passes through the interstices of disc 21 to reach the pretreatment element 20. Most contaminating substances are trapped in element 20 by absorption and catalytic oxidation and carbon monoxide molecules pass through the central hole in the pretreatment element 20, in registration with the central hole in disc 19, into the sensor chamber B. The carbon monoxide is oxidised to carbon dioxide on the upper catalytic surface, the resulting electrical output being proportional to the carbon monoxide concentration. The circular disc 16 containing absorbed sulphuric acid acts as a reservoir which feeds or drains the sensor electrode as the volume of electrolyte expands and contracts with temperature and humidity changes.

Claims

1. Carbon monoxide sensor apparatus comprising pre-treatment means and sensor means, in which the pre-treatment means comprises an aqueous medium to absorb contaminating substances from a gaseous test substrate and catalytic means to convert contaminating substances to non-contaminating substances at ambient temperatures.
2. Apparatus according to claim 1, in which the pre-treatment and sensor means are contained in separate chambers in mutual communication, the pretreatment chamber including access means for the gaseous test substrate.
3. Apparatus according to claim 1 or claim 2, in which the sensor means comprise an electrochemical sensor comprising two electrochemically-active electrodes separated by an electrolyte absorbed on a porous substrate.
4. Apparatus according to claim 3, in which the sensor electrodes comprise a precious metal as catalyst.
5. Apparatus according to claim 4, in which the catalyst is disposed on a porous support.
6. Apparatus according to claim 4, in which the catalyst is applied direct to the electrode surface in finely-divided form.
7. Apparatus according to any of claims 3 to 6, in which the porous substrate comprises a plastics polymeric material.
8. Apparatus according to any of claims 3 to 7, in which the electrolyte is acidic.
9. Apparatus according to any preceding claim, in which the aqueous medium contains sulphuric acid or other water-retention substance.
10. Apparatus according to any preceding claim, in which the aqueous medium is absorbed on a solid absorbent matrix.
11. Apparatus according to any preceding claim and including a porous barrier to exclude airborne particulates from the pre-treatment means.

AMENDED SHEET

*Fig.1.**Fig.2.*

DECLARATION FOR PATENT APPLICATION

Attorney Docket: 82341
Page 1 of 2

As a below-named inventor(s), I/we hereby declare that:

My/Our residence(s), post office address(es) and citizenship(s) is/are as stated below next to my/our name(s).

I/We believe I/we am/are the original inventor, first and sole (if only one name is listed below) or the original, first and joint inventors (if plural names are listed below) of the subject matter which is claimed, and for which a patent is sought on the invention entitled:

CARBON MONOXIDE SENSOR

the specification of which: (check one)

☐ is attached hereto.

☒ was filed on 15 June 2000, as Serial No. PCT/GB00/02348,

and was amended on _____ (if applicable).

We hereby state that we have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We acknowledge the duty to disclose information which is material to the patentability of this application as defined by 37 CFR § 1.56.

We hereby claim foreign priority benefits under 35 U.S.C. § 119 of any foreign application(s) for patent or inventor's certificate listed below, and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Applications:

			Priority Claimed
<u>9913946.1</u>	<u>GB</u>	<u>15 / June / 1999</u>	<input checked="" type="checkbox"/> <input type="checkbox"/>
(Application No.)	(Country)	(Day/Month/Year Filed)	Yes No
<u> </u>	<u> </u>	<u> </u>	<input type="checkbox"/> <input type="checkbox"/>
(Application No.)	(Country)	(Day/Month/Year Filed)	Yes No
<u> </u>	<u> </u>	<u> </u>	<input type="checkbox"/> <input type="checkbox"/>
(Application No.)	(Country)	(Day/Month/Year Filed)	Yes No

We hereby appoint Gary M. Nath, Reg. No. 26,965; Harold L. Novick, Reg. No. 26,011; Todd L. Juneau, Reg. No. 40,669; Lee C. Heiman, Reg. No. 41,827; Jerald L. Meyer, Reg. No. 41,194; Joshua B. Goldberg, Reg. No. 44,126; Marvin C. Berkowitz, Reg. No. 47,421; and Joseph K. Hemby, Jr., Reg. No. 48,652 as my attorneys to prosecute this application and transact all business in the U.S. Patent and Trademark Office connected therewith.

Direct Telephone Calls to:

Harold L. Novick
(202) 775-8383

Send Correspondence to:
NATH & ASSOCIATES PLLC
Sixth Floor
1030 15th Street, N.W.
Washington, D.C. 20005 U.S.A.

We hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by 35 U.S.C. § 112, first paragraph, I/we acknowledge the duty to disclose material information as defined in 37 CFR § 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(U.S. Application Serial No.)	(U.S. Filing Date)	(Status--patented, pending, abandoned)
(U.S. Application Serial No.)	(U.S. Filing Date)	(Status--patented, pending, abandoned)

DECLARATION FOR PATENT APPLICATION

Attorney Docket: 82341
Page 2 of 2

I/We hereby claim the benefit under 35 U.S.C 119(e) of any United States provisional application(s) listed below:

(Application Number(s))

Filing Date

We hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor: Walter John KINGInventor's Signature W King

Date

25 January 2002Residence: The Gardens, Priory Orchard, Totnes, Devon TQ9 5HR, GREAT BRITAINGBCountry of Citizenship: GREAT BRITAINPost Office Address: Same as residence